URS OPERATING SERVICES

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February 22, 2011

Steve Way
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U.S. Environmental Protection Agency, Region 8
Mail Code: 8EPA-SA
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Denver, Colorado 80202-1129

SUBJECT: START 3, EPA Region 8, Contract No. EP-W-05-050, TDD No. 1008-01 Field Sampling Plan, Red and Bonita Mine, Silverton, San Juan County, Colorado

Dear Steve:

Attached are two copies of the draft Field Sampling Plan for the Red and Bonita Mine in Silverton, San Juan County, Colorado. Field activities are anticipated to be conducted in late February or March 2011. This document is submitted for your approval and comments.

If you have any questions, please call me at 303-291-8269

Yours sincerely,

URS OPERATING SERVICES, INC.

Joe Gilbert, PG
Project Manager

cc: Charles W. Baker/UOS (w/o attachment)
Joe Gilbert/UOS
File/UOS

START 3

Superfund Technical Assessment and Response Team 3 – Region 8

United States
Environmental Protection Agency
Contract No. EP-W-05-050

FIELD SAMPLING PLAN

RED AND BONITA MINE
Silverton, San Juan County, Colorado

TDD No. 1008-01

February 22, 2011

URS
OPERATING SERVICES, INC.

In association with:
Garry Struthers Associates, Inc.
LT Environmental, Inc.
TechLaw, Inc.
Tetra Tech EM, Inc.
TN & Associates. Inc.

FIELD SAMPLING PLAN

RED AND BONITA MINE
Silverton, San Juan County, Colorado

EPA Contract No. EP-W-05-050
TDD No. 1008-01

Prepared By:
Joe Gilbert, PG
Project Manager

URS Operating Services, Inc.
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Denver, CO 80202-1908

Approved: ______________________________ Date: ______________
Steve Way, On-Scene Coordinator, EPA, Region 8

Approved: ______________________________ Date: ______________
Charles W. Baker, START 3 Program Manager, UOS

Approved: ______________________________ Date: ______________
Joe Gilbert, PG, START 3, UOS

DISTRIBUTION LIST

U.S. ENVIRONMENTAL PROTECTION AGENCY

Steve Way (2 copies)	On-Scene Coordinator, EPA Region 8

URS OPERATING SERVICES, INC.

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File (2 copies)	START 3, EPA Region 8

FIELD SAMPLING PLAN
for
Removal Assessment

Red and Bonita Mine
Silverton, San Juan County, Colorado

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1.0 INTRODUCTION

URS Operating Services, Inc. (UOS) has been tasked by the U.S. Environmental Protection Agency (EPA), under the EPA Region 8 Superfund Technical Assessment and Response Team 3 (START) Contract No. EP-W-05-050, to conduct a removal assessment (RA) at the Red and Bonita Mine (CERCLIS ID# CON000802811) in Silverton, San Juan County, Colorado. Field work for this RA began in October 2010. Due to the seasonal changes at the site, additional field work is scheduled and is anticipated to be completed during February or March 2011.

This Field Sampling Plan (FSP) is designed to guide field operations during the RA, and has been prepared in accordance with Technical Direction Document (TDD) #1008-01 and the "UOS Generic Quality Assurance Project Plan" (QAPP) (UOS 2008). The RA field work will include sampling and non-sampling data collection. UOS START plans to sample surface water from Cement Creek and discharge water coming from the adits on site, including American Tunnel, Red and Bonita Mine, Gold King #7 Mine, Mogul Mine, and Grand Mogul Mine. Sampling procedures will adhere strictly to those outlined in the UOS Technical Standard Operating Procedures (TSOPs) for field operations at hazardous waste sites (UOS 2005).

Site characterization samples will potentially include 8 surface water samples and 1 field Quality Assurance/Quality Control (QA/QC) duplicate sample (Table 1). The QA/QC samples will follow the requirements of the "Guidance for Choosing a Sampling Design for Environmental Data Collection" (EPA 2002).

All samples will be analyzed through a private contracted laboratory for special analyses.

2.0 OBJECTIVES

The purpose of this RA is to gather information regarding sources of discharge in the Upper Cement Creek area. The specific objectives of this RA field event are to:

- Assess similarities among adit releases, through Tritium and stable isotope analysis, before response actions in the upper Cement Creek watershed. Samples will be collected from surface water and mine water for analysis.
- Maintain the data-logging transducers that were installed during previous field efforts.

- Gather additional metals and water quality parameters from existing and new sample locations in the Upper Cement Creek Watershed.

3.0 BACKGROUND INFORMATION

3.1 SITE LOCATION AND DESCRIPTION

Cement Creek originates in the San Juan Mountains of southwestern Colorado near the San Juan County and Ouray County line on the south-facing slopes of Red Mountain Number 3 and the north slopes of Storm Peak. Cement Creek begins at an elevation of 13,000 feet above mean sea level (MSL) and flows 7 miles southward to an elevation of 9,305 feet above MSL at its confluence with the Animas River at Silverton, Colorado (Figures 1 and 2) (Colorado Department of Public Health and Environment [CDPHE] 1998). The name Cement Creek probably refers to the iron rich precipitates (ferricrete) that coat and cement the stream bed materials (U. S. Geological Survey [USGS] 2007e). This investigation will focus on the Upper Cement Creek basin, including sample locations at the American Tunnel Mine, Gold King #7 Mine, Red and Bonita Mine, Mogul Mine, and Grand Mogul Mine.

3.2 SITE CHARACTERISTICS

3.2.1 Physical Geography

The areas under investigation are located north to northwest of the town of Silverton, Colorado.

3.2.2 Geology

The Cement Creek basin is located in the volcanic terrain of the San Juan Mountains. The area was a late Oligocene volcanic center that witnessed the eruption of many cubic miles of lava and volcanic tuffs that covered the area to a depth of more than a mile (USGS 1969). The formation of the 10-mile diameter Silverton caldera produced faults that are generally concentric circular features. The caldera collapse was followed by multiple episodes of hydrothermal activity that produced widespread alteration and mineralization of the rocks (USGS 2007a). Cement Creek flows through the middle of the old Silverton caldera (EPA 1999).

The predominant rock type found in the Cement Creek Basin is the Oligocene-age Silverton Volcanics. The Silverton Volcanics are lava flows of intermediate to silicic composition and related volcaniclastic sediments that accumulated to a thickness of approximately 1,000 feet around older volcanoes prior to the subsidence of the Silverton Caldera (USGS 2002).

The regional propylitization of the rocks in the area prior to the collapse of the calderas created an altered regional rock type that contains significant amounts of calcite ($CaCO_3$), epidote ($Ca_2Fe(Al_2O)(OH)(Si_2O_7)(SiO_4)$), and chlorite ($(MgFeAl)_6(SiAl)_4O_{10}(OH)_8$), all of which contribute to the intrinsic acid-neutralizing capacity of the major regional rock type. Three major areas of post-caldera collapse mineralization and alteration have been identified in the Cement Creek drainage. The Ohio Peak-Anvil Mountain (OPAM) area on the west side of the lower Cement Creek drainage and the Red Mountains area on the northwest side of the upper Cement Creek drainage are both sites of 23-million-year-old acid-sulfate mineralization. The Eureka Graben area on the upper northeast side of the Cement Creek drainage is the site of an 8- to 10-million-year-old emplacement of northeast-trending polymetallic veins of silver, lead, zinc, copper, and often gold that formed as fracture- or fissure-filling material (USGS 2007d).

The Red Mountain and OPAM acid-sulfate hydrothermal systems cover 4.5 square miles and 4.1 square miles, respectively, along the margin of the collapsed Silverton Caldera on the west and northwest side of the Cement Creek Drainage. Most of the mineralization and mining activity in these two areas have occurred in the Red Mountain area with mines and adits related to the Red Mountain acid-sulfate system found in Prospect, Dry, Georgia, and Corkscrew Gulches, all tributaries of Cement Creek. The ores from these mines commonly contain enargite (Cu_3AsS^4), galena (PbS), chalcocite (Cu_2S), tetrahedrite ($(Cu,Fe)_{12}(Sb,As)_4S_{13}$), stromeryite (AgCuS), bornite (Cu_5FeS_4), chalcopyrite ($CuFeS_2$), and pyrite (FeS_2) along with elemental arsenic (As), copper (Cu), lead (Pb), and iron (Fe) (USGS 2007d).

Mineralization in the veins of the Eureka Graben that is drained by upper Cement Creek include massive pyrite and milky quartz (FeS_2—$Si0_2$), chalcopyrite ($CuFeS_2$), galena (PbS), sphalerite (ZnS), fluorite (CaF), and elemental gold (Au) and silver (Ag) (USGS 2007d).

The San Juan Mountains were nearly covered by alpine glaciers during the latest Pleistocene Pinedale glaciation. The thickness of glacial ice is estimated to have ranged from approximately 1,400 feet thick at Gladstone to 1,700 feet thick at Silverton. The Pinedale glaciation ended approximately 12,000 years ago, and except for the glacial till deposits, all surface sediments along Cement Creek were likely deposited after that date (USGS 2007e). Approximately 6,000 years ago, Cement Creek cut into the creek bed sediments by as much as 16 feet, causing a drop in the valley bottom shallow water table aquifer. Beginning about A.D. 400, Cement Creek aggraded the stream bed by as much as 10 feet, then between A.D. 1300 and A.D. 1700, Cement Creek cut back to the previous level established approximately 6,000 years ago. These changes in the shallow water table elevations in the valley caused mineralization and cementation of the sediments in the stream course (USGS 2007e).

Recent human activities have had relatively little influence on the overall shape and physical processes of Cement Creek (USGS 2007e).

3.2.3 Hydrogeology

Groundwater in the Cement Creek area is found in cracks and fissures in the near surface of the igneous rocks that make up the majority of the area.

3.2.4 Hydrology

The drainage area of Cement Creek is 20.1 square miles (USGS 2007b). Cement Creek flows through the middle of the old caldera, with the period of high flow being May, June, and July, in response to snowmelt in the San Juan Mountains, and the periods of low flow occurring in winter and late summer (EPA 1999). The average flow measured by the USGS on Cement Creek at Silverton before the confluence with the Animas River at station number 09358550 between 1992 and 2008 (excluding 1994) was 38.3 cubic feet per second (cfs). The highest average flow on Cement Creek was 56.3 cfs during 1995 and the lowest was 17 cfs during the drought of 2002 (USGS 2009). The drainage area of the Animas River is 146 square miles (USGS 2007b). The average flow measured by the USGS on the Animas River below Silverton at station number 09359020 between 1992 and 2008 was 281 cfs (USGS 2009).

3.2.5 Meteorology

The Red and Bonita Mine site is located in an alpine climate zone. The mean annual precipitation is about 40 inches. Winter snowfall is heavy, and severe rain storms occur in the summer (USGS 1969). The average total precipitation for Silverton, Colorado as totaled from the Western Regional Climate Center database is 24.50 inches. The 2-year, 24-hour rainfall event for this area is 2 inches (National Oceanic and Atmospheric Administration [NOAA] 1973).

3.3 CONCEPT OF OPERATIONS

3.3.1 Schedule

Field work is scheduled for late February or March 2011. Sampling is estimated to be completed in approximately 3 to 5 days. Non-sampling data collection will be performed as appropriate.

3.3.2 Safety

All field activities will be conducted in strict accordance with an approved UOS Site Health and Safety Plan, which will be developed before the start of field activities. It is anticipated that all field work can be accomplished in Level D personal protective equipment.

3.3.3 Site Access and Logistics

UOS will obtain site access with the assistance, if necessary, of the EPA Region 8 Site Assessment Manager for this site. UOS will have written consent from all applicable property owners (onsite and offsite) prior to the field sampling event.

3.4 SAMPLE LOCATIONS AND TRANSDUCER MAINTENANCE

This sampling event involves the collection of up to four surface water and four mine water stable isotope samples, as shown in Figure 2 (Tables 1 and 2). Due to the time of year and anticipated snow-cover, some sampling locations may not be accessible. All sample points will be located on a topographic map or with a Global Positioning System (GPS) device after sample collection.

This procedure will allow documentation of changes in sample locations as they occur in the field due to unanticipated site conditions.

Potential surface water samples will be collected from Cement Creek above Grand Mogul Mine and Mogul Mine. Mine water samples will be collected from adits at American Tunnel, Gold King #7 Mine, Red and Bonita Mine, and Mogul Mine, as well as from North Fork above Gold King #7 Mine, and at the toe of a waste pile at Grand Mogul Mine.

Four data-logging pressure transducers were installed at the American Tunnel, the Red and Bonita Mine, Gold King #7, and the Mogul Mine. These transducers will be serviced during this field event. Servicing includes:

- Cleaning yellow-boy or bacterial precipitate buildup on the instruments;
- Downloading existing data on the instrument using a field computer;
- Replacing O-rings and silica grease that binds instrument components;
- Replacing silica desiccant package on transducer cables; and
- Cleaning of flume stilling wells and field measurements of stilling well/transducer depths.

3.5 SAMPLING METHODS

3.5.1 <u>Surface Water and Mine Water Sampling</u>

UOS will measure field parameters, including pH, temperature, and electrical conductivity, of each sample collected as described in TSOP 4.14 "Water Sample Field Measurements." All data will be recorded on appropriate sample forms. Sampling will be conducted from the farthest downstream location to the farthest upstream location to minimize the potential for cross-contamination. Two types of surface water sample collection will be implemented at each sampling location.

<u>Stable Water Isotope Sample Collection</u>

Stable water isotope samples will be collected in two 30-milliliter (mL) borosilicate glass vials with airtight caps. The containers must be certified clean. Alternatively two 15 to

30-mL high-density polyethylene (HDPE) bottles may be used, if glass containers are at risk of breaking in the field during sampling. HDPE containers may be filled until full. Containers will not be pre-rinsed before sampling. No preservation or filtration is necessary. Glass bottles will be filled two-thirds full with sample water to allow for samples to freeze without bottle breakage. After sample collection, bottle caps will be sealed with Parafilm or tape to avoid evaporation and interaction with ambient air. Samples will be stored on ice or frozen in HDPE containers immediately after collection. All sampling locations will be documented in the logbook and photographed.

Tritium Sample Collection

Tritium water samples will be collected in two 1-Liter glass containers with air tight caps. The containers must be certified clean. Alternatively, two 1-Liter HDPE bottles may be used if glass containers are at risk of breaking in the field during sampling. Containers will not be pre-rinsed before sampling. No preservation or filtration is necessary. Bottles will be completely filled, avoiding any air bubbles in the container. A peristaltic pump may be used if the water source is not of sufficient depth to fill the bottles directly, and dedicated tubing will be used if this is the case. The bottles will be inverted to check for air bubbles. After sample collection, bottle caps will be sealed with Parafilm or tape to avoid evaporation and interaction with ambient air. Samples can be stored at ambient temperature. All sampling locations will be documented in the logbook and photographed.

3.6 CONTROL OF CONTAMINATED MATERIALS

Investigation-derived waste (IDW) generated during the sampling event will be handled in accordance with UOS TSOP 4.8, "Investigation-Derived Waste Management," and the OERR Directive 9345.3-02, "Management of Investigation-Derived Waste During Site Inspections," May 1991 (UOS 2005; EPA 1991).

3.7 ANALYTICAL PARAMETERS

Table 2, the Sample Plan Checklist, lists all sample parameters. All samples will be analyzed for stable water isotopes by the University of Colorado. Samples will be analyzed for Tritium by the USGS.

4.0 CHAIN OF CUSTODY

After sample collection and identification, all samples will be handled in strict accordance with the chain-of-custody protocol specified in UOS TSOP 4.3, "Chain of Custody" (UOS 2005).

5.0 MEASUREMENT QUALITY OBJECTIVES

5.1 FIELD QUALITY CONTROL PROCEDURES

All samples will be handled and preserved as described in UOS TSOP 4.2, "Sample Containers, Preservation, and Maximum Holding Times." Calibration of the pH, temperature, and conductivity meters will follow instrument manufacturers' instruction manuals and UOS TSOP 4.14, "Water Sample Field Measurements." Sample collection will progress from downstream to upstream to prevent cross-contamination (UOS 2005).

All non-disposable, pre-cleaned sampling equipment will be decontaminated before and after use in accordance with UOS TSOP 4.11, "Equipment Decontamination." Basic decontamination will consist of washing or brushing gross particulate off sampling equipment with tap water and a scrub brush, followed by washing equipment with a solution of Liquinox and distilled water, and rinsing with distilled water. After decontamination, the equipment will be allowed to gravity drain (UOS 2005).

The following sample will be collected to evaluate quality assurance at the site in accordance with the UOS Generic QAPP (UOS 2008):

- One duplicate surface water sample per set of 20 samples collected. One will be required for this site.

The UOS Generic QAPP serves as the primary guide for the integration of QA/QC procedures for the START contract (UOS 2008).

5.2 DATA QUALITY INDICATORS

Data quality assessment to determine data quality and usability will include:

- A QA/QC review of field-generated data and observations;

- Individual data validation reports for all sample delivery groups;
- Review of the procedures used by the validator to qualify data for reasons related to dilution, reanalysis, and duplicate analysis of samples;
- Evaluation of QC samples such as field replicates and laboratory control samples to assess the quality of the field activities and laboratory procedures;
- Assessment of the quality of data measured and generated in terms of accuracy, precision, and representativeness; and
- Summary of the usability of the data, based upon the assessment of data conducted during the previous steps.

5.2.1 Bias

Bias is systematic or persistent distortion of a measurement process that causes errors in one direction. The extent of bias can be determined by an evaluation of laboratory initial calibration/continuing calibration verification, laboratory control spike/laboratory control spike duplicates, blank spike, and Method Blank.

Bias will be controlled at the Upper Cement Creek sites by the laboratory.

5.2.2 Precision

Precision is the measure of agreement among repeated measurements of the same property under identical, or substantially similar, conditions and is expressed as the relative percent difference between the sample pairs.

At the mine sites, precision will be attained by comparing the duplicate sample from the mine and surface water sampling.

5.2.3 Representativeness

Representativeness is the measure of the degree to which data accurately and precisely represent a characteristic of a population parameter, variations at a sampling point, a process condition, or an environmental condition. Representativeness encompasses both the degree to which measurements reflect the actual concentration, and the degree to which sampling units reflect the population they represent. The effect of representativeness should be considered on two levels: within the sample unit and between sample units. Aspects of representativeness include adherence to TSOPs for sampling procedures, field and laboratory QA/QC procedures, appropriateness of sample material collected, compositing to increase sample representativeness, homogenization, analytical method and sample preparation, and achievement of measurement quality objectives (MQO) for the project.

During sample collection at the Upper Cement Creek sites, TSOPs will be strictly adhered to so that data are precise and accurate.

5.2.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system. The actual percentage of completeness is less important than the effect of completeness on the data set.

5.2.5 Comparability

Comparability is the qualitative term that expresses the confidence that two data sets can contribute to common interpretation and analysis and is used to describe how well samples within a data set, as well as two independent data sets, are interchangeable.

Results obtained from mine and surface water sampling at all sample locations will be used to determine discharge sources by comparing stable isotope results from the respective surface water samples. It is important that sampling technique and laboratory analysis are correct so that comparison is accurate.

6.0 DATA QUALITY ASSESSMENT AND REPORTING

Data will be supplied to EPA for analysis.

7.0 LIST OF REFERENCES

Colorado Department of Public Health and Environment (CDPHE), Hazardous Materials and Waste Management Division (HMWMD) 1998. Site Inspection Analytical Results Report, Cement Creek Watershed, San Juan County, Colorado.

National Oceanic and Atmospheric Administration (NOAA). 1973. NOAA Atlas 2 – Precipitation-Frequency Atlas of the Western United States, Volume III-Colorado.

U.S. Environmental Protection Agency (EPA). 1991. Guidance for Performing Preliminary Assessments under CERCLA. EPA/540/G-91/013. September 1991.

U.S. Environmental Protection Agency (EPA). 1999. Prioritization of Abandoned Mines in the Animas Watershed, Southwestern Colorado. Carol Cox Russell.
http://www.epa.gov/hardrockmining/scitosci/scifiles/422-animas.pdf

U.S. Environmental Protection Agency (EPA). 2002. Guidance for Choosing a Sampling Design for Environmental Data Collection. EPA QA/G-5S. EPA 240/R-02/005. December 2002.

U.S. Geological Survey (USGS). 1969. "Geology and Ore Deposits of the Eureka and Adjoining Districts, San Juan Mountains, Colorado. Wilbur S. Burbank and Robert G. Luedke. Geological Survey Professional Paper 535.

U.S. Geological Survey (USGS). 2002. "Generalized Geologic Map of Part of the Upper Animas River Watershed and Vicinity, Silverton, Colorado. Douglas B. Yeager and Dana J. Bove. Miscellaneous Field Studies Map MF-2377.

U.S. Geological Survey (USGS). 2007a. *Integrated Investigations of Environmental Effects of Historical Mining in the animas River Watershed. San Juan County, Colorado.* Professional Paper 1651. Volume 1. Chapter E3, "Major Styles of Mineralization and Hydrothermal Alteration and Related Solid- and Aqueous-Phase Geochemical Signatures." By Dana J. Bove, M. Alisa Mast, J. Bradley Dalton, Winfield G. Wright, and Douglas B. Yager.

U.S. Geological Survey (USGS). 2007b. *Integrated Investigations of Environmental Effects of Historical Mining in the Animas River Watershed. San Juan County, Colorado.* Professional Paper 1651. Volume 1. Chapter B, "The Animas River Watershed, San Juan County, Colorado." By Paul von Guerard, Stanley E. Church, Douglas B. Yager, and John M. Besser.

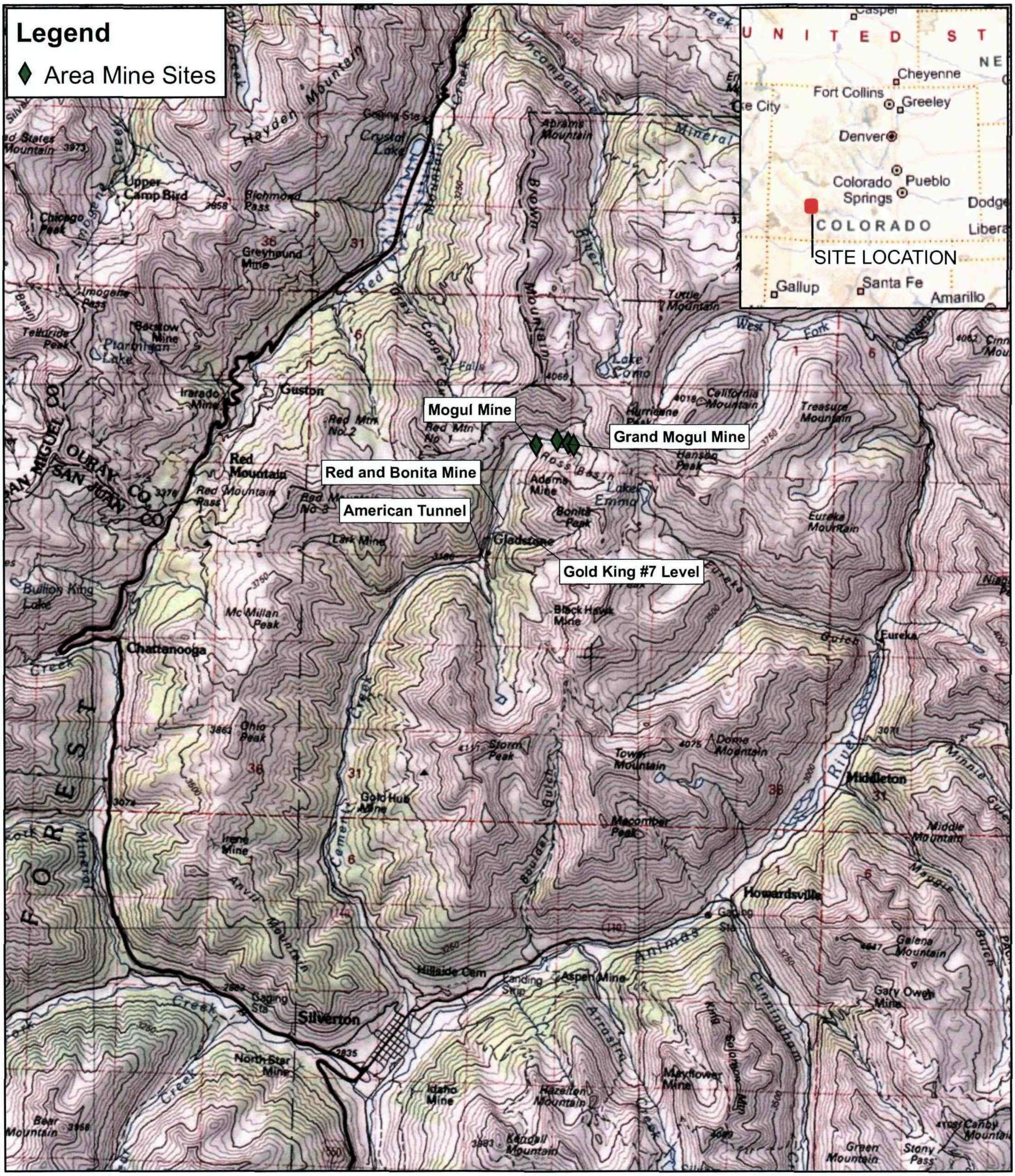
U.S. Geological Survey (USGS). 2007d. *Integrated Investigations of Environmental Effects of Historical Mining in the Animas River Watershed. San Juan County, Colorado.* Professional Paper 1651. Volume 1. Chapter E3, "Major Styles of Mineralization and Hydrothermal Alteration and Related Solid- and Aqueous-Phase Geochemical Signatures." By Dana J. Bove, M. Alisa Mast, J. Bradley Dalton, Winfield G. Wright, and Douglas B. Yager.

U.S. Geological Survey (USGS). 2007e. *Integrated Investigations of Environmental Effects of Historical Mining in the Animas River Watershed. San Juan County, Colorado.* Professional Paper 1651. Volume 2. Chapter E16, "Geomorphology of Cement Creek and its Relation to Ferricrete Deposits." By Kirk R. Vincent, Stanley E. Church, and Laurie Wirt.

U.S. Geological Survey (USGS). 2009. National Water Information System: Web Interface. http://waterdata.usgs.gov/nwis

URS Operating Services, Inc. (UOS). 2005. "Technical Standard Operating Procedures for the Superfund Technical Assessment and Response Team (START), EPA Region 8."

URS Operating Services, Inc. (UOS). 2008. "Generic Quality Assurance Project Plan" for the Superfund Technical Assessment and Response Team 2, Region 8. June 13, 2005.



Projection System:
Universal Transverse
Mercator Zone 13 North
North American Datum 1983

0 1.5 3

Miles

TDD Title: **Red and Bonita Mine**

Figure: 1

Figure Title: SITE LOCATION

TDD County: SAN JUAN

TDD State: CO

TDD: 1008-01

Date: 02/2011

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Sources:
USGS Topographic Map
Bing Maps

February, 2011; File Name: T:\START3\Red and Bonita Mine\GIS\Maps\FSP_ISOTOPE\March2011_Isotope_sampling\F1_SiteLocationMap.mxd; Joe Gilbert

February, 2011; File Name: T:\START3\Red and Bonita Mine\GIS\Maps\Analysis_maps_nofigures\Isotope_Sample_locations.mxd; Joe Gilbert

TABLE 1
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Mine Water	CC01C	To be collected from the toe of the waste pile at Grand Mogul Mine.	Determine the age of the water by stable isotope and tritium analysis.
Surface Water	CC01F	To be collected from the Ross Basin Drainage above Grand Mogul.	
Mine Water	CC02D	To be collected from adit at Mogul Mine.	
Surface Water	USCC02D	To be collected from Cement Creek above Mogul Mine.	
Mine Water	CC03C	To be collected from the adit at Red and Bonita Mine.	
Mine Water	CC04	To be collected from North Fork above Gold King #7 Level Mine.	
Mine Water	CC08	To be collected from Gold King #7 Level Mine.	
Mine Water	CC19	To be collected from American Tunnel Mine.	
QA/QC	CC20	To be determined in field.	

TABLE 2
Sample Plan Checklist

		Field Parameters			Analysis			Quality Control Samples		
Sample Location	Sample Type	Temp	pH	Cond	Stable Water Isotopes – H	Stable Water Isotopes – O	Tritium	Dup	Spike	Blank
CC01C	Mine Water	X	X	X	X	X	X			
CC01F	Surface Water	X	X	X	X	X	X			
CC02D	Mine Water	X	X	X	X	X	X			
USCC02D	Surface Water	X	X	X	X	X	X			
CC03C	Mine Water	X	X	X	X	X	X			
CC04	Surface Water	X	X	X	X	X	X			
CC08	Mine Water	X	X	X	X	X	X			
CC19	Mine Water	X	X	X	X	X	X			
CC20	Surface Water	X	X	X	X	X	X	X		

TABLE 3
Sample Container Types, Volumes, and Sample Preservation

Sample Matrix	Analysis	Analysis Mode	Required Detection Limits	Units	Container Number and Type[2]	Required Volume	Preservation	Analysis Time
Surface Water	Stable Water Isotopes – ^{2}H	Dual inlet	NA	NA	1 – 30 mL glass or HDPE vial	2 mL minimum 15 mL preferred	None	4-6 weeks
Surface Water	Stable Water Isotopes – O	Dual inlet	NA	NA	1 – 30 mL glass or HDPE vial	2 mL minimum 15 mL preferred	None	4-6 weeks
Surface Water	Tritium – ^{3}H	Liquid scintillation	NA	TU	2 – 1 L glass or HDPE	1 L	None	2-4 weeks
Mine Water	Stable Water Isotopes – ^{2}H	Dual inlet	NA	NA	1 – 30 mL glass or HDPE vial	2 mL minimum 15 mL preferred	None	4-6 weeks
Mine Water	Stable Water Isotopes – O	Dual inlet	NA	NA	1 – 30 mL glass or HDPE vial	2 mL minimum 15 mL preferred	None	4-6 weeks
Mine Water	Tritium – ^{3}H	Liquid scintillation	NA	TU	2 – 1 L glass or HDPE	1 L	None	2-4 weeks

NA Not Applicable
TU Tritium Units
mL Milliliter
L Liter
HDPE High-density polyethylene